PROCEEDINGS

OF

THE ROYAL SOCIETY.

November 15, 1888.

Professor G. G. STOKES, D.C.L., President, in the Chair.

In pursuance of the Statutes, notice of the ensuing Anniversary Meeting was given from the Chair.

Mr. John Ball, Sir James Cockle, Dr. Huggins, Dr. Rae, and Mr. Symons were by ballot elected Auditors of the Treasurer's accounts on the part of the Society.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

I. "Combustion in dried Oxygen." By H. BRERETON BAKER, M.A., Dulwich College, late Scholar of Balliol College, Oxford. Communicated by Professor H. B. DIXON, F.R.S. Received July 4, 1888.

(Abstract.)

In 1884 some preliminary experiments, published in the 'Journal of the Chemical Society,' convinced me that moisture exerted an important influence on the combustion of carbon. Since that time experiments have been made, not only with that element but with several others, and the same influence seems to be exerted on the combustion of some, while no such influence could be detected in the case of other elements. It was discovered very early in the investigation that hydrogen, both free and combined, aided the union of carbon with dried oxygen, and therefore for the new experiments on this and other elements, special attention was devoted to their purification from hydrogen. It was found that two of these elements, amorphous phosphorus and boron, had, like carbon, a very great power of occluding hydrogen. To eliminate it some of the elements were heated in a current of pure chlorine, while others were heated in sealed tubes with the chlorides of the elements, special precautions being taken to

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free the purified elements from all traces of the agents used in their purification. In this way the elements—carbon, sulphur, boron, and phosphorus, the latter in both red and yellow modifications—were found to have their combustion influenced by the dryness of the oxygen. Some chemical union was found to take place, the extent of which varied with the dryness of the substances. In no case, however, did it manifest itself by flame. Ordinary phosphorus was obtained so pure as not to glow in the oxygen dried by phosphorus pentoxide, though the pressure was increased and diminished in every possible way. If water was added rapid combustion at once set in.

The elements—selenium, tellurium, arsenic, and antimony—were purified with as much care as was expended on the elements mentioned above. Their combustion was, however, not found to be affected in any way by the dryness of the gas.

In the course of the investigation two facts were discovered about the combustion: (i) of amorphous phosphorus, and (ii) of charcoal in oxygen. Amorphous phosphorus is generally regarded as being incapable of true combustion. It is asserted that before amorphous phosphorus can be heated to its kindling point, it changes into ordinary phosphorus, which then burns. This has been proved not to be the case. Amorphous phosphorus was heated in a current of nitrogen, free from traces of oxygen, to 260°, 278°, and 300°, in three experiments, without undergoing any change to the ordinary modification. If moist oxygen was substituted for the nitrogen combustion took place at 260°. It seems, therefore, probable that amorphous phosphorus undergoes a true combustion in oxygen without previous change to the ordinary modification.

With regard to the combustion of carbon, it has always been a doubtful question which of the two oxides is first formed. Is carbon monoxide the first product, undergoing further oxidation to the dioxide, or is carbon dioxide the first and only substance formed? The problem seems incapable of direct solution. It is, however, open to indirect attack. When carbon is heated in a current of oxygen dried for a short time by phosphorus pentoxide, a slow combustion goes on, and, though the oxygen is in excess, both oxides are produced. The amount of monoxide, however, is twenty times the amount of the dioxide. Experiments also show that this occurs at temperatures at which dry carbon dioxide is not reduced by carbon. The carbon monoxide must, therefore, be produced by the direct union of its elements, its further oxidation being prevented by the dryness of the gases. Confirmatory experiments were performed in which carbon monoxide was found to be produced by the slow combustion of carbon in air at 440°, a temperature too low for the reduction of the dioxide by carbon. It is probable that the ordinary combustion of carbon goes on in two stages, that carbon monoxide is

first produced, and, if circumstances are favourable, this is further oxidised to carbon dioxide.

II. "On the Mechanical Conditions of a Swarm of Meteorites, and on Theories of Cosmogony." By G. H. DARWIN, LL.D., F.R.S., Fellow of Trinity College and Plumian Professor in the University of Cambridge. Received July 12, 1888.

(Abstract.)

Mr. Lockyer writes in his interesting paper on Meteorites* as follows:—

"The brighter lines in spiral nebulæ, and in those in which a rotation has been set up, are in all probability due to streams of meteorites with irregular motions out of the main streams, in which the collisions would be almost *nil*. It has already been suggested by Professor G. Darwin ('Nature,' vol. 31, p. 25)—using the gaseous hypothesis—that in such nebulæ 'the great mass of the gas is non-luminous, the luminosity being an evidence of condensation along lines of low velocity according to a well-known hydrodynamical law. From this point of view the visible nebula may be regarded as a luminous diagram of its own stream-lines.'"

The whole of Mr. Lockyer's paper, and especially this passage in it, leads me to make a suggestion for the reconciliation of two apparently divergent theories of the origin of planetary systems.

The nebular hypothesis depends essentially on the idea that the primitive nebula is a rotating mass of fluid, which at successive epochs becomes unstable from excess of rotation, and sheds a ring from the equatorial region.

The researches of Roche† (apparently but little known in this country) have imparted to this theory a precision which was wanting in Laplace's original exposition, and have rendered the explanation of the origin of the planets more perfect.

But notwithstanding the high probability that some theory of the kind is true, the acceptance of the nebular hypothesis presents great difficulties.

Sir William Thomson long ago expressed to me his opinion that the most probable origin of the planets was through a gradual accretion of meteoric matter, and the researches of Mr. Lockyer afford actual evidence in favour of the abundancy of meteorites in space.

* 'Nature,' Nov. 17, 1887. The paper itself is in 'Roy. Soc. Proc.,' Nov. 15, 1887 (No. 259, p. 117).

† 'Montpellier, Acad. Sci. Mém.'